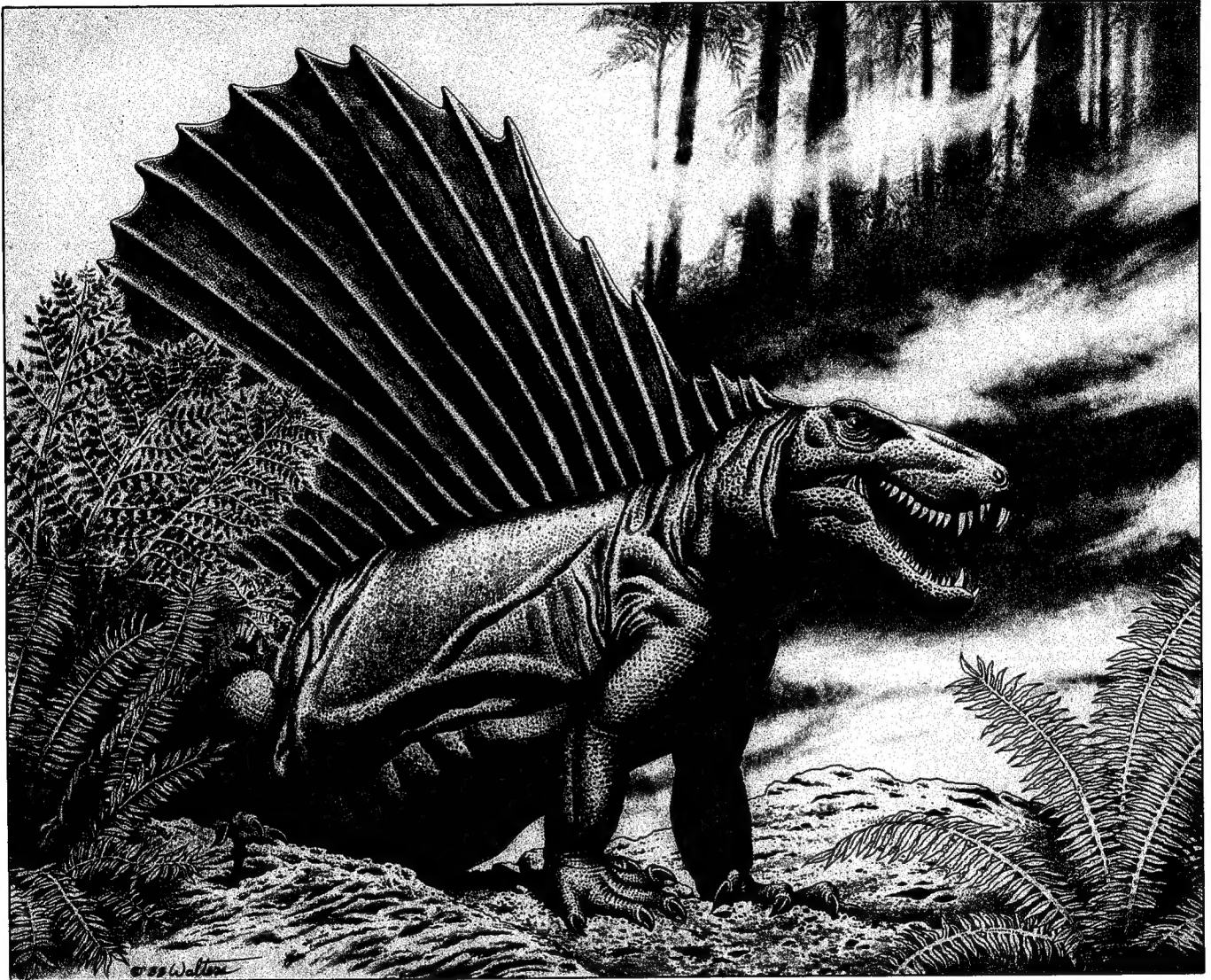


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Upper Triassic *Dinophyton* Zone Plant Fossils from the Stockton Formation in Southeastern Pennsylvania

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Abstract

An occurrence of Upper Triassic plant megafossils in the upper shale member of the Stockton Formation in Phoenixville, Pennsylvania, is briefly described. The paleoflora, which represents the first report of the *Dinophyton* zone from the Newark Basin, includes leafy shoots and pinwheels of *Dinophyton spinosus* and *Zamites powelli* leaves. The conifers are represented by the leafy shoots of *Pagiophyllum simpsonii*, *P. diffusum*, *Striatotaxus triassicus*, articulated *Glyptolepis* sp. cones, isolated cone scales and seeds, and an unidentified cone-like structure.

Introduction

In early 1987, the authors excavated a rich paleoflora from the upper shale member of the Stockton Formation in Phoenixville, Pennsylvania, including several forms never before reported from the Newark Basin. Subsequently, they learned that H. C. Lewis of the Academy of Natural Sciences of Philadelphia had collected bivalves, fish, and plants from the locality in 1884 (Lewis, 1884). Lewis referred to the plants as freshwater "coal plants" and did not mention specific forms. Unfortunately, Lewis' plant fossil specimens have not been located although the bivalves were redescribed by Richards (1944). In his paper, Richards incorrectly reported the location of the site as Mont Clair, Pennsylvania. The authors have learned that Dr. Paul Olsen of the Lamont-Daugherty Geological Observatory collected plant fossils, ostracodes, bivalves, and beetle elytron from the locality in 1982 (Olsen, personal communication, 1987).

Many of the identifications given herein are considered preliminary because the cuticle is not preserved on the fossils. Identification is also complicated by the fact that the Newark flora is in need of review and revision. Nevertheless, it appears, based on the presence of the leafy shoots and pinwheels of *Dinophyton spinosus* and an associated upper Carnian palynoflora (Bruce Cornet, personal communication, 1988), that the paleoflora at this locality correlates with the Zone of *Dinophyton* of Ash (1980).

Geology

The Stockton Formation is the oldest and poorest-known formation of the Newark Basin (Olsen, 1980). In eastern Pen-

nsylvania, the Stockton Formation has been divided into the lower arkosic, middle arkosic, and upper shale members (Rima et al., 1961).

The Phoenixville plant locality occurs in the upper shale member which consists principally of red shale; however, the plant fossils occur in a thin (20 cm) layer of gray shale which is atypical of the member. According to Olsen (1980), most of the Stockton Formation fossils occur in such atypical beds. The upper shale member is 60 feet thick (3 percent of the formation) at Phoenixville and is conformably overlain by the Lockatong Formation (Rima et al., 1961).

The fossiliferous layer is exposed in the abandoned Pennsylvania Railroad cut north of French Creek in Phoenixville, Chester County, Pennsylvania. Exact locality data is on file at the North Museum of Franklin and Marshall College.

Biostratigraphy

Four floral zones of Late Triassic to Early Jurassic age have been recognized in North America (Ash, 1980, 1987). They are the Zone of *Eoginkoites* (middle Carnian), the Zone of *Dinophyton* (late Carnian), the Zone of *Sanmiguelia* (Norian/Rhaetian), and a poorly known unnamed upper zone probably of Rhaeto-Liassic age.

The Zone of *Dinophyton* is widely represented in the Upper Triassic of the southwestern United States; however, until this report it was recognized in the eastern Triassic only from the New Oxford Formation of the Gettysburg Basin in York County, Pennsylvania (Cornet, 1977).

The Phoenixville plant fossils represent the first recognized occurrence of the Zone of *Dinophyton* in the Newark Basin. The presence of this zone in the upper Stockton Formation which also produced the *Eoginkoites* zone flora at Carversville, Bucks County, Pennsylvania (Bock, 1969) appears anomalous and merits further investigation.

Paleontology

The problematic fossil *Dinophyton spinosus* occurs only rarely at the Phoenixville site. As is typical of *Dinophyton*, the foliage is represented by fragments of the ultimate shoot with attached leaves (Ash, 1970). The foliage and pinwheel structures have not yet been found connected at any *Dinophyton* locality (Ash, 1970a) including the new Phoenixville occurrence.

Rarely encountered as fossils at Phoenixville are leaves of *Zamites powelli*. This fossil is represented primarily by isolated pinnae. The specimens in Plate 1, Figure 2, and one unfigured specimen, are the only articulated fronds collected to date. Some pinnae display small circular craters with a medial stalk referable to the supposed fungus *Xylomites zamitae* (Bock, 1969).

The leafy branches of three conifer species are represented at Phoenixville, the most common being those of *Pagiophyllum simpsonii*. Some pieces of the gray shale are completely covered with overlapping branches of this fossil. *P. simpsonii* can be distinguished from most other species of *Pagiophyllum* by its small (0.8-1.2 mm wide, 1.7-2.0 mm long) leaves (Ash, 1970b). Leafy branches of the conifer *P. diffusum* are also abundant. This fossil is similar to *P. simpsonii* except the leaves are longer (2.5-4.5 mm) and flatter. The leaves of both species are spirally attached but are oriented in a single plane in *P. diffusum* (Cornet, 1977). Leafy branches similar to *Striatotaxus triassica* from Bock's (1969) Carversville locality occur rarely at Phoenixville.

Several articulated cones similar to Cornet's (1977) *Glyptolepis* nov. sp. 1 have been collected. These cones have not been found attached to any of the leafy branches at Phoenixville; however, Cornet's (1977) York County specimens have shown that they belong to the *Pagiophyllum diffusum* branches. Another currently unidentified cone-like structure has also been found. Isolated cone scales and seeds are commonly encountered. Ferns tentatively identified as *Todites* sp. also occur at the Phoenixville site.

Conclusion

As Olsen (1980) has pointed out, Newark Basin rocks have generally been considered fossil-poor; however, recent investigations are showing these rocks to be richer in well-preserved fossils than previously thought. It is hoped that the present report will support this view and stimulate further research into Newark Basin paleobotany.

Acknowledgements

We are grateful to Dr. Sidney R. Ash for reprints and his useful criticisms, to Dr. Paul Olsen for enlightening discussions and for encouraging us to write this paper, and to Dr. Bruce Cornet for sharing his unpublished palynological information. Special thanks to Lawrence Decina for the literature search and Earle Spamer of the Academy of Natural Sciences of Philadelphia for providing us with access to the Wilhelm Bock collection.

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Plate 1

Some representative plant fossils from the Stockton Formation at Phoenixville, Chester County, Pennsylvania. Figured specimens are reposit at the North Museum (NM) of Franklin and Marshall College, Lancaster, Pennsylvania. All scales are in mm.

- 1 *Dinophyton spinosus* leafy shoot (NM PL-243).
- 2 *Zamites powelli* leaves (NM PL-244).
- 3 *Pagiophyllum simpsonii* branch (NM PL-245). The border encloses the unidentified cone-like structure and a *Dinophyton* pinwheel.
- 4 An enlargement of the cone-like structure and *Dinophyton* pinwheel shown in Figure 3.
- 5 Isolated seed with *Pagiophyllum simpsonii* branch fragments (NM PL-247).
- 6 *Glyptolepis* sp. cone (NM PL-246).

